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TELEOLOGY.

Design in Nature. By Dr. J. Bell Pettigrew, F.R.S. In three volumes; with nearly 2000 figures and three portraits of the author. Vol. i., pp. xxxi+421; vol. ii., pp. xi+425-1069; vol. iii., pp. ix+1073-1416. (London: Longmans, Green and Co.) Price £3 3s. net.

ALTHOUGH the manuscript of these three large volumes was completed by the author, it was not until after his death that the greater portion of the book passed through the press. In these circumstances nothing remained for the editors but faithfully to carry out the work of publishing "*Design in Nature*" in the form in which it was left, although, as they point out, many improvements would no doubt have suggested themselves to Prof. Pettigrew if he had lived to see the book in type. The aim and object of the work was to demonstrate the existence of a first cause, or Creator, from the study of the phenomena of the organic and inorganic worlds.

In attempting to deal with physics, chemistry, botany, zoology, anatomy, physiology, psychology and palæontology "more or less in detail," the author attempted a task which no one man could be expected adequately to perform. A discussion of such a wide range of subject-matter, to be really conclusive in its arguments, would have to run to the size of an encyclopædia, and, like the latter, be the work of a number of different contributors. As it is, the extent of knowledge covered may be described as being as broad as the ocean, but lacking in depth. Indeed, there is considerable want of uniformity, and many of the arguments are distinctly shallow. A large part of the work deals with anatomical, zoological, and physiological considerations, especially in relation to organs of reproduction, circulation, and locomotion, but other matters, such as the telephone, bones of the hand and foot, spiral formations, and new theories of matter, are dropped down rather at random in the middle of discussions with which they do not appear to have much connection. Moreover, the same subject is sometimes discussed in two widely different places.

It would be impossible to deal at any great length with the theoretical aspect of the book. We can only select one or two illustrations. On p. 767 are given fourteen "proofs that the brain is the organ, apparatus, or laboratory of the mind." Some of these are legitimate deductions from statements for which Prof. Pettigrew's authority affords sufficient guarantee, but the argument is surely weakened by the inclusion of the following:—

"1. The brain rests eight hours or so (period of sleep), and during that time the mind is a blank."

"4. The intellectual faculties are sluggish after a full meal. They are most active between meals. They are also more active during the day than during the night."

"6. When the brain is overworked during the day,

sleep at night is difficult or impossible. The brain apparatus is excited, and endless mental pictures, known as dreams, are formed."

"8. Mesmerism is largely a physical condition."

"13. The brain can be trained and developed. It is impossible to train and develop what is immaterial."

"Weight, Momentum, and Power as Factors in Flight" is the heading of § 378, from which we extract the following:—

"The increase of power due to momentum in heavy bodies in motion is well illustrated in the start and progress of steamboats. In these the *slip*, as it is technically called, decreases as the speed of the vessel increases; the strength of two or three men, if applied by a hawser attached to the stern of a moderate-sized vessel, being sufficient to retard, and, in some instances, prevent, the starting. In such a case the power of the engine is almost entirely devoted to 'slip' or in giving motion to the fluid in which the screw or paddle is immersed. It is consequently not the power residing in the paddle or screw which is cumulative, but the momentum inhering in the mass. In the bird the momentum, *alias* weight, is made to act upon the inclined planes formed by the wings, thus adroitly converting it into sustaining and propelling power. It is to this circumstance, more than any other, that the prolonged flight of birds is mainly due, the inertia or dead weight of the trunk aiding and abetting the action of the wings, and so relieving the excess of exertion which would necessarily devolve on the bird." . . . "In the flight of the albatross, on the other hand, the momentum acquired by the moving mass does the principal part of the work, the wings for the most part being simply rotated on and off the wind to supply the kite surfaces and angles necessary for the inertia or mass to operate upon."

From these examples we can only advise the reader to regard "*Design in Nature*" as a memorial volume of the late Prof. Pettigrew, and not to attach too great scientific value to statements and conclusions which the author might have expunged or modified had he lived to complete his task.

Since the above criticisms were written, a fresh aspect of Prof. Pettigrew's work has suggested itself to the present reviewer. A large portion of the three volumes deals with matters anatomical. Now, anatomy is a subject which, for reasons that the psychologist alone is competent to explain, is not pleasing to the majority of individuals. It is highly desirable that the mind which controls the human mechanism should know as much as possible about the working of that mechanism as well as of those of other members of the animal kingdom; yet the parent's letter to the board school teacher, "Please don't learn my little girl any more about her inside; it does her no good and is rude," represents a widespread sentiment which, whatever its origin, is opposed both to the true scientific spirit and to considerations of expediency. Now Prof. Pettigrew certainly succeeded in associating a great deal of information on this usually unpalatable subject in connection with an appeal to one of man's highest sentiments—his appreciation of beauty and order in the universe, and his reverence for that first cause which must have produced the countless results that cannot

be attributed to mere chance. Any reader, whether scientific or otherwise, who will study the book in this spirit, will, unless he has already specialised in anatomy, derive great benefit from the information which he will acquire on this particular branch of science.

A TREATISE ON THE PROTOZOA.

A Treatise on Zoology. Edited by Sir E. Ray Lankester, K.C.B., F.R.S. Part i., Introduction and Protozoa. First fascicle. Pp. xxii+296. (London: A. and C. Black, 1909.) Price 15s. net.

THE publication of the present volume completes the account of the Protozoa, the other sections of which were dealt with in the second fascicle, which appeared in 1903. An introductory chapter from the pen of the editor is followed by a series of separate treatises by various authors. To Prof. Hickson has fallen the task of dealing with a number of organisms, grouped into the class Proteomyxa, many of which have been seen only once and have been so imperfectly investigated that practically nothing is known of their nuclear condition. The author has given a systematic account of the organisms, which he has arranged into five groups. The structure and life-history of a few of the better-known forms, such as *Plasmodiophora brassicae* (the cause of "finger and toes" in turnips), are briefly considered.

The section on Heliozoa has been written conjointly by the late Prof. Weldon and Prof. Hickson. A clear account is given of the structure, fission, and nuclear changes seen in these Protozoa, particular attention being devoted to the observations of Schaudinn and R. Hertwig on the nuclear phenomena presented by *Actinosphaerium* and *Acanthocystis*. The reproductive processes of the former organism are carefully considered in view of the statement that self-fertilisation appears to be of normal occurrence, but the facts are capable of other interpretation, as is clearly shown in the discussion of the published observations. Mr. J. J. Lister has given an admirable account of the Mycetozoa, organisms which usually receive scant attention in courses of zoology, but which are here brought before the notice of teachers and students in a manner which compels attention to the interesting phenomena they present.

The Lobosa are described by Prof. Hickson in an article which might well have been of greater length in order to permit the more detailed treatment of the life-histories of some of the organisms considered. The author has changed the spelling of the now well-known name *Entamoeba* to *Endamoeba*, but there is surely no warrant for such an alteration, which is to be greatly deprecated.

Dr. Gamble's clear and comprehensive account of the Radiolaria is deserving of high praise, especially for the prominence given to the biology and physiology of these organisms. *Thalassicolla* is chosen as a type for description, following which the chief modifications in structure of the Radiolaria are considered. An account is given of the recent observations on somatic variation and on somatic and gametic dimorphism, while flotation, the central capsule, nuclear and repro-

ductive phenomena, the skeleton and its biological significance, subjects in regard to which the Radiolaria present special features of interest, are well treated. The author fully discusses the relation of the yellow cells to the organisms. He points out that, though nitrogenous excreta are formed in abundance, there is no accumulation in most Radiolaria of excretory substances, the absence of which, it is suggested, is due to the action of the yellow cells, which, attracted to their host chemotactically, derive their nitrogen from the urea and uric acid which they find therein. Support is afforded to this view by the fact that masses of granules—the phæodellæ—which are regarded as excretory by Borgert, do occur in quantity in the one division of the Radiolaria (the Phæodaria) in which yellow cells are constantly absent. The yellow cells of Spumellaria and Nassellaria are bounded by a cell wall and leave their host on the death of the latter, but those of Acantharia have lost the power of independent existence; they have become assimilating granules and are transmitted from parent to offspring.

Dr. Willey and Prof. Hickson have given a useful account of the Mastigophora. A little more extended reference to the characters and life-history (so far as it is known) of flagellates, such as *Leishmania* and *Trichomonas*, which are found in man and other animals, would have been helpful to many readers. *Trichomonas intestinalis* is mentioned as occurring in the intestine of mice; its occurrence in man is not referred to. The authors reject the genus *Cercomonas*; they should have at least indicated to which genus the well-known species associated with man should be referred. In the description of *Euglena* we miss reference to Wager's observations on the nature of the base of the flagellum.

Dr. Woodcock's section on the Hæmoflagellata, which is a critical summary of the extensive literature of this subject, will be of great service to students of zoology and of medicine. The author strongly upholds the status of the kinetonucleus as a true nucleus homologous with the trophonucleus, the two being specialised for different functions; the kinetonucleus is not merely an extra-nuclear centrosome as held by Moore and Breinl. The section on the life-history of trypanosomes presents a clear discussion of this difficult subject. The author announces (in a footnote, p. 239) that during the investigation of the hæmatozoa of the chaffinch he obtained unmistakable evidence that the trypanosome and halteridium of the chaffinch are ontogenetically connected, thus supporting the observations of Schaudinn on the corresponding organisms in the little owl. Dr. Woodcock gives a brief account of the "Leishman-Donovan-Wright" bodies, which he regards as intimately related to *Piroplasma* on account of their nuclear dimorphism and mode of fission. Attention is directed in this connection to the recent accumulation of evidence in favour of the flagellate affinities of *Piroplasma*. The author's discussion of the nature of spirochætes is too brief to give him the opportunity of dealing in an adequate manner with this vexed question, but he is evidently of the opinion that they are not Protozoa. The article concludes with a useful list of the known natural hosts of trypanosomes and allied forms.